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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/812,355

03/30/2004

Hongyu Yue

071469-0307699 (ES-040)

4102

7590

11/18/2008

Eric Strang
Suite 10
4350 W. Chandler Blvd.
Chandler, AZ 85226

EXAMINER

CHEN, KIN CHAN

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

11/18/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/812,355	YUE, HONGYU	
	Examiner	Art Unit	
	Kin-Chan Chen	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 October 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4,5 and 8-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4,5 and 8-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114 was filed in this application after a decision by the Board of Patent Appeals and Interferences, but before the filing of a Notice of Appeal to the Court of Appeals for the Federal Circuit or the commencement of a civil action. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on October 1, 2008 has been entered.

Claim Rejections - 35 USC § 112

1. Claims 1, 4, 5, and 8-12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 1, "determining a single, continuous relationship" and "trim amount data ranging up to about 35 nm" is new matter because they are not supported in the specification.

Claims 1, 4, 5, and 8-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, "determining a single, continuous relationship" is vague and indefinite because it is not described in the specification and it is unclear as to the meaning of the phrase.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 4, 5, and 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomoyasu et al. (US 2004/0185583; hereinafter "Tomoyasu").

In a method for chemical oxide removal, Tomoyasu (abstract; ([0007], [0059], [0074], [0200]; Fig. 2) teaches that a chemical oxide removal process may be performed using a process recipe including a first reactant, a second reactant, and a process

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pressure in order to acquire trim amount data as a function of a variable parameter.

Tomoyasu (abstract; ([0007], [0059], [0074], [0200]; Fig. 2) teaches that a process recipe including setting an amount of a first reactant, a second reactant such as NH_3 , HF, H_2 , O_2 , CO, CO_2 , Ar, He, see [0200]. Hence, it would have been obvious to one with ordinary skill in the art to **use these gases and combinations thereof**. Tomoyasu [0007, lines 4-5] teaches setting an amount of an inert gas in order to achieve the trim amount.

Tomoyasu [0007, lines 4-5] teaches adjusting one or more chemical processing parameters, therefore, it reads on applicant's "maintaining at least one constant parameter constant". Tomoyasu teaches the claimed variable parameters. Tomoyasu ([0007], [0074]) teaches that the etch rate model (which is a function of variable parameters) can be used along with a processing time to computer an etch depth (so-called target trim amount in the instant claims) which is considered to read on applicant's "using the target trim amount and the relationship to determine a target value for the variable parameter". Tomoyasu ([0007][0200]) teaches changing process pressure and chemical treatment gas flow rates (e.g., gas flow rates of HF, NH_3 , or inert gas). Since gas flow rates of process gases are controlled and known, back to the commonly known basic fluid (gas) mechanics principles, the ratio of volumetric flow rates of gas A and gas B is corresponding to the ratio of partial pressure of gas A and gas B, and is also corresponding to the molar ratio of gas A and gas B, hence, it would have been obvious to one with ordinary skilled in the art that changing process pressure and chemical treatment gas flow rates will change partial pressure of each gas and also

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change the molar ratio of reactants accordingly. Tomoyasu also teaches thermally treating the substrate and rinsing the substrate following the chemical treating.

Tomoyasu ([0007], [0074]) teaches adjusting the amount of inert gas (gas flow rate) in order to remove the desired amount of the chemical oxide. Tomoyasu teaches using charts, and various models for analysis. Tomoyasu clearly shows that process parameters and composition of chemical treatment gases are result-effective variables.

The process of conducting routine experimentations so as to produce an expected result is obvious to one of ordinary skill in the art. In the absence of showing criticality or new, unexpected results, a person having ordinary skill in the art would have found it obvious to modify the prior art by performing routine experiments (by using different process parameters and compositions) to obtain optimal result with a reasonable expectation of success.

Changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical (i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). MPEP 2144.05 II.

Claim 1 differs from the prior art by specifying trim amount data up to about 35 nm. Because same are merely a matter of choices of design depending on the product requirements, in absence of showing criticality or unexpected results, it would be obvious to one skilled in the art to use various sizes of trim amount for fabricating a semiconductor device in order to accommodate the specific product design and meet the product requirement.

As to dependent claim 10, see [0062].

As to dependent claims 11 and 12, see [0041] and [0074].

4. Claims 1 and 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Natzle et al. (US 2004/0097047; hereinafter "Natzle") in view of Tomoyasu et al. (US 2004/0185583) or Newton et al. (US 2004/0099377).

In a method for chemical oxide removal, Natzle ([0014], [0037],[0038], [0042]-[0044]) teaches that a chemical oxide removal process may be performed using a process recipe including a first reactant , a second reactant, and a process pressure.. Natzle [0042] teaches acquiring trim amount data as a function of variable parameters (such as temperature, composition, residence time pressure of the reactant, the amount of reactant or the rate of reactant), **all of which can be regulated**, which is considered to read on applicant's " maintaining at least one constant parameter constant". Natzle [0042] also discloses that the aforementioned variable parameters influence the amount removed. Therefore, it would have been obvious to one with ordinary skill in the art to use the target trim amount and the relationship to determine a target value for the variable parameter". The instantly claimed invention differs from Natzle by specifying well-known features (such as adding inert gas to the etchant) to the art of semiconductor device fabrication. In a method for chemical oxide removal, Tomoyasu teaches that a chemical oxide removal process may be performed using a process recipe including setting an amount of treatment gases such as NH₃, HF, H₂, O₂, CO, CO₂, Ar, He, see [0200]. In a method for chemical oxide removal, Newton ([0073],[0074]), teaches that a chemical oxide removal process may be performed using

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a process recipe including setting an amount of a first reactant, a second reactant, and inert gas (e.g., HF, NH₃, or inert gas). Newton teaches setting an amount of an inert gas in order to achieve the trim amount. Because it is a well-known feature in the art of semiconductor device fabrication and because it is disclosed by Tomoyasu or Newton, hence, it would have been obvious to one with ordinary skill in the art to incorporate inert gas in the process of Natzle, in order to efficiently remove the chemical oxide.

The aforementioned references clearly show that process parameters and composition of chemical treatment gases are result-effective variables. The process of conducting routine experimentations so as to produce an expected result is obvious to one of ordinary skill in the art. In the absence of showing criticality or new, unexpected results, a person having ordinary skill in the art would have found it obvious to modify the prior art by performing routine experiments (by using different process parameters and compositions) to obtain optimal result with a reasonable expectation of success.

Changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical (i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). MPEP 2144.05 II.

Natzle teaches changing pressure of reactant and flow rates, since gas flow rates of process gases are controlled and known, back to the commonly known basic fluid (gas) mechanics principles, the ratio of volumetric flow rates of gas A and gas B is corresponding to the ratio of partial pressure of gas A and gas B, and is also corresponding to the molar ratio of gas A and gas B, hence, it would have been obvious to one with ordinary skilled in the art that changing process pressure and chemical

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treatment gas flow rates will change partial pressure of each gas and also change the molar ratio of reactants accordingly.

As to dependent claim 10, see [0014] of Natzle.

As to dependent claims 11 and 12, after gathering information of etching rates, thickness, process parameters), it would have been obvious to one with ordinary skill in the art to tabulate / extrapolate / manipulate data and perform calculation using common statistical methods (such as regression, extrapolation, best-fit, polynomial, least squares, interpolation) and numerical analysis. It is noted that applicant did not traverse the aforementioned conventionality (e.g., common knowledge), which have been stated in the previous office action (January 12, 2006).

Claim 1 differs from the prior art by specifying trim amount data up to about 35 nm. Because same are merely a matter of choices of design depending on the product requirements, in absence of showing criticality or unexpected results, it would be obvious to one skilled in the art to use various sizes of trim amount for fabricating a semiconductor device in order to accommodate the specific product design and meet the product requirement.

5. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Natzle in view of Tomoyasu or Newton as applied to claim 1 above, and further in view of Doris et al. (US 2004/0241981; hereinafter "Doris").

The discussion of modified Natzle (in view of Tomoyasu or Newton) from above is repeated here.

The modified Natzle (in view of Tomoyasu or Newton) is silent about the heating and rinsing with water after the chemical treating. In a method for chemical oxide removing, Doris teaches heating and rinsing with water after the chemical treating so as to efficiently remove the solid reaction product, see [0046]. Hence, it would have been obvious to one with ordinary skill in the art to modify Natzle (in view of Tomoyasu or Newton) by heating and rinsing with water as taught by Doris in order to efficiently remove the solid reaction product.

Response to Arguments

6. Applicant's arguments filed October 1, 2008 have been fully considered but they are not persuasive.

Applicant has argued that prior art does not teach changing the molar ratio of reactants. It is not persuasive. As has been stated in the office action, prior art teaches changing pressure of reactant and flow rates, since gas flow rates of process gases are controlled and known, back to the commonly known basic fluid (gas) mechanics principles, the ratio of volumetric flow rates of gas A and gas B is corresponding to the ratio of partial pressure of gas A and gas B, and is also corresponding to the molar ratio of gas A and gas B, hence, it would have been obvious to one with ordinary skilled in the art that changing process pressure and chemical treatment gas flow rates will change partial pressure of each gas and also change the molar ratio of reactants accordingly.

Applicant has argued that Tomoyasu teaches a process gas comprising two gases but not teaches a first process gas, a second gas, and an inert gas. It is not persuasive. As has been stated in the office action, Tomoyasu (abstract; ([0007], [0059],[0074], [0200]; Fig. 2) teaches that a chemical oxide removal process may be performed using a process recipe including setting an amount of a first reactant , a second reactant such as NH_3 , HF, H_2 , O_2 , CO, CO_2 , Ar, He, see [0200]. Hence, it would have been obvious to one with ordinary skill in the art to **use these gases and combinations thereof** .

Applicant has request the examiner to show the evidence of the use of inert gas with process gas in a chemical oxide removal process to remove a trim amount is well known. As has been stated in the office action, Tomoyasu teaches that a chemical oxide removal process may be performed using a process recipe including setting an amount of treatment gases such as NH_3 , HF, H_2 , O_2 , CO, CO_2 , Ar, He, see [0200]. In a method for chemical oxide removal, Newton ([0073],[0074]), teaches that a chemical oxide removal process may be performed using a process recipe including setting an amount of a first reactant, a second reactant, and inert gas (e.g., HF, NH_3 , or inert gas).

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kin-Chan Chen/
Primary Examiner, Art Unit 1792

November 8, 2008